

PATENT

EXPRESS MAIL EL 669109644US

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicants : Ritzdorf et al.
Application No. : 09/018,783 Confirmation No.: 1242
Filed : 2/4/98
For : METHOD AND APPARATUS FOR LOW TEMPERATURE
ANNEALING OF METALLIZATION MICRO-STRUCTURES
IN THE PRODUCTION OF A MICROELECTRONIC DEVICE

Examiner : Deven M. Collins
Art Unit : 2823
Docket No. : 29195.8162US
Date : October 1, 2001

FAX COPY RECEIVED

Commissioner for Patents
Washington, DC 20231

OCT 25 2001

TECHNOLOGY CENTER 2800

TRANSMITTAL OF INFORMATION DISCLOSURE STATEMENT

Sir:

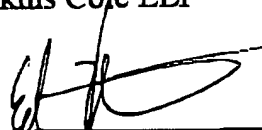
In accordance with 37 C.F.R. §§ 1.56 and 1.97 through 1.98, applicants wish to make known to the Patent and Trademark Office the references set forth on the attached form PTO/SB/08A (copies of the cited references, as required under 37 C.F.R. § 1.98, are enclosed). Although the aforesaid references are made known to the Patent and Trademark Office in compliance with applicants' duty to disclose all information of which they are aware that is believed relevant to the patentability of the above-identified application, applicants believe that their invention is patentable. As to any document supplied, applicants do not admit that it is "prior art" under 35 U.S.C. §§ 102 or 103, and

specifically reserve the right to antedate any such document, as by a showing under 35 C.F.R. § 1.131 or other method.

Please acknowledge receipt of this Information Disclosure Statement and kindly make the cited references of record in the above-identified application. As the present information disclosure statement is being filed as a submission under 37 CFR §1.114(a), no fee is believed necessary under 37 CFR §1.97. If any such fee is necessitated by this filing, such fees may be charged to Deposit Account 50-0665.

Respectfully submitted,

Perkins Coje LLP



Edward S. Hotchkiss
Registration No. 33,904

ESH:scc

Enclosures:

Postcard

Form PTO/SB/08A

Cited References (39)

P.O. Box 1247

Seattle, Washington 98111-1247

(206) 583-8888

Fax: (206) 583-8500

TECHNOLOGY CENTER 2800
OCT 25 2001
FAX COPY RECEIVED 2

PTO/SB/08A

Please type a plus sign (+) inside this box → ☐

As used for use through 10/31/99. OMB 0651-0031
 Patent and Trademark Office: U.S. DEPARTMENT OF COMMERCE

Substitute for form 1449A/PTO

INFORMATION DISCLOSURE STATEMENT BY APPLICANT *(use as many sheets as necessary)*

COMPLETE IF KNOWN

Application Number 09/018,783
 Confirmation Number 1242
 Filing Date 2/4/98
 First Named Inventor Ritzdorf
 Group Art Unit 2823
 Examiner Name Deven M. Collins
 Attorney Docket No. 29195.8162US

Sheet

1

of

3

U.S. PATENT DOCUMENTS

*EXAMINER INITIALS	Cite No.	U.S. Patent Document		Name of Patentee or Applicant of Cited Document	Date of Publication of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
		NUMBER	Kind Code (if known)			
Dne	AA	5,972,192		Dubin <i>et al.</i>	10/26/99	
	AB	4,250,004		Miles <i>et al.</i>	2/10/81	
	AC	3,894,918		Corby <i>et al.</i>	7/15/75	
	AD	2,443,599		Allan E. Chester	6/22/48	
	AE	5,605,615		Goolsby <i>et al.</i>	2/25/97	
	AF	6,280,183		Mayur <i>et al.</i>	8/28/01	
↓	AG	6,278,089		Young <i>et al.</i>	8/21/01	

FOREIGN PATENT DOCUMENTS

*EXAMINER INITIALS	Cite No.	Foreign Patent Document			Name of Patentee or Applicant of Cited Document	Date of Publication of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear	T
		Office	Number	Kind Code (if known)				

OTHER PRIOR ART-NON PATENT LITERATURE DOCUMENTS

*EXAMINER INITIALS	Cite No.	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume/issue number(s), publisher, city and/or country where published.
Dne	AH	NGUYEN <i>et al.</i> , "Interconnect and Contact Metallization", Eds. H.S. Rathore, G.S. Mathan, C. Plougonven and C.C. Schuckert, PV 97-31, The Electrochemical Society, Inc., Pennington, NJ
	AI	FOULKE, D.G., in "Gold Plating Technology", Reid, F.H. and Goldie, W., p.67, Electrochemical Publication Limited, British Isles (1996).
	AJ	TOMOV, V., STOYCHEV, D.S., VITANOVA, I.B., "Recovery And Recrystallization Of Electrodeposited Bright Copper Coatings At Room Temperature. II. X-Ray Investigation Of Primary Recrystallization," <i>Journal of Applied Electrochemistry</i> , 15, 887-894. Chapman and Hall Ltd. (1985).
	AK	RITZDORF, T., GRAHAM, L., JIN, S., MU, C. and FRASER, D., "Self-Annealing of Electrochemically Deposited Copper Films in Advanced Interconnect Applications," Proceedings of the IEEE 1998 International Interconnect Technology Conference, San Francisco, CA (June 1-3, 1998).
	AL	DUBIN, V.M., SHACHAM-DIAMAND, Y., ZHAO, B., VASUDEV, P.K. and TING, C.H., "Sub-Half Micron Electroless Cu Metallization," Materials Research Society Symposium Proceedings, Vol. 427, San Francisco (1996).
↓	AM	COOK, M. and RICHARDS, T., "The Self-Annealing of Copper," <i>J. Inst. Metals</i> , vol. LXX, pp. 159-173 (1943).

Please type a plus sign (+) inside this box → ☐A. used for use through 10/31/99. OMB 0651-0031
Patent and Trademark Office: U.S. DEPARTMENT OF COMMERCE

Substitute for form 1449A/PTO

**INFORMATION DISCLOSURE
STATEMENT BY APPLICANT**
(use as many sheets as necessary)**COMPLETE IF KNOWN**

Application Number	09/018.783
Confirmation Number	1242
Filing Date	2/4/98
First Named Inventor	Ritzdorf
Group Art Unit	2823
Examiner Name	Deven M. Collins
Attorney Docket No.	29195.8162US

Sheet	2	of	3
<i>Dmc</i>	AA	MAK, C.Y., "Electroless Copper Deposition on Metals and Metal Silicides," Materials Research Society Bulletin, (August 1994).	
	AB	HOGAN, B.M., "Microstructural Stability of Copper Electroplate," (citation unknown but believed to be published more than one year before the date of this patent application).	
	AC	STOYCHEV, D., VITANOVA, I. VIEWEGER, U., "Influence of the Inclusions in Thick Copper Coatings on Their Physico - Mechanical Properties," (citation unknown but believed to be published more than one year before the date of this patent application).	
	AD	STOYCHEV, D.S., and AROYO, M.S., "The Influence of Pulse Frequency on the Hardness of Bright Copper Electrodeposits," <i>Plating & Surface Finishing</i> , pp. 26-28 (date unknown but believed to be published more than one year before the date of this patent application).	
	AE	STOYCHEV, D.S., and AROYO, M.S., "On the Influence of Pulse Frequency on the Hardness of Bright Copper Electrodeposits," (citation unknown but believed to be published more than one year before the date of this patent application).	
	AF	STEIN, B., "A Practical Guide to Understanding, Measuring and Controlling Stress in Electroformed Metals," presented at the AESF Electroforming Symposium, Las Vegas, NV (March 1996).	
	AG	SANCHEZ, J. JR., BESSER, P.R., and FIELD, D.P., "Microstructure of Damascene Processed Al-Cu Interconnects for Integrated Circuit Applications," presented at the Fourth International Workshop on Stress Induced Phenomena in Metallizations, Tokyo, Japan (June 1997).	
	AH	SANCHEZ, J. JR. and BESSER, P.R., "Modelling Microstructure Development in Trench-Interconnect Structures," submitted to International Interconnect Technology Conference, Sunnyvale, CA. (June 1998).	
	AI	FIELD, D.P., SANCHEZ, J. JR., BESSER, P.R., DINGLEY, D.J., "Analysis of Grain-Boundary Structure in Al-Cu Interconnects," <i>J. Appl. Phys.</i> , 82(5) (September 1, 1997).	
	AJ	GUPTA, D., "Comparative Cu Diffusion Studies in Advanced Metallizations of Cu and Al-Cu Based Thin Films," Materials Research Society Symposium Proceedings, San Francisco, CA (April 1994).	
	AK	MEGAW, H.D. and STOKES, A.R., "Breadths of X-Ray Diffraction Lines and Mechanical Properties of Some Cold-Worked Metals," <i>J. Inst. Metals</i> , vol. LXXI, pp. 279-289 (1944).	
	AL	THOMPSON, C.V., and KNOWLTON, B.D., "Designing Circuits and Processes to Optimize Performance and Reliability: Metallurgy Meets Tech," <i>Microelectronics and Reliability</i> , 36, P. 1683 (1996).	
	AM	CAREL, R., THOMPSON, C.V., FROST, H.J., <i>Material Research Society Symposium</i> , Vol. 343, Materials Research Society (1994).	
	AN	FLORO, J.A., CAREL, R. and THOMPSON, C.V., "Energy Minimization During Epitaxial Grain Growth: Strain vs. Interfacial Energy," <i>Material Research Society Symposium</i> , Vol. 317, Materials Research Society, (1994).	
	AO	PLÖTNER, M., URBANSKY, N., PREUSZ, A. and WENZEL, C., "Control of Mechanical Stresses and their Temperature Dependence in PVD CU Films," presented at Adv. Metalliz. & Interconn. Syst. ULSI Applic. San Diego (1997).	
✓	AP	WONG, CHEE, C., SMITH, H.L., and THOMPSON, C.V., "Secondary Grain Growth and Graphoepitaxy in Thin Au Films on Submicrometer-Period Gratings," <i>Material Research Society Symposium Proc.</i> , Vol. 47, Materials Research Society (1985).	

PTO/SB/08A

Please type a plus sign (+) inside this box → ☐Ad for use through 10/31/99. OMB 0651-0031
Patent and Trademark Office: U.S. DEPARTMENT OF COMMERCE

Substitute for form 1449A/PTO

**INFORMATION DISCLOSURE
STATEMENT BY APPLICANT**

(use as many sheets as necessary)

COMPLETE IF KNOWN

Application Number	09/018,783
Confirmation Number	1242
Filing Date	2/4/98
First Named Inventor	Ritzdorf
Group Art Unit	2823
Examiner Name	Deven M. Collins

Attorney Docket No. 29195.8162US

Sheet

3

of

3

Dac

AA

THOMPSON, C.V., and SMITH, H.I., "Secondary Grain Growth in Thin Films." *Material Research Society Symposium Proc.*, Vol. 57, Materials Research Society (1987).

AB

WONG, C.C., SMITH, H.I., and THOMPSON, C.V., "Room Temperature Grain Growth in Thin Au Films from Grain Boundary Structure and Related Phenomena, supplement to *Transactions of Japanese Institute of Metals*, 27, p. 641 (1986).

AC

THOMPSON, C.V., "Observations of Grain Growth in Thin Films," from *Microstructural Science for Thin Film Metalizations in Electronics Applications*, eds. J. Sanchez, D.A. Smith and N. DeLanerolle, The Minerals, Metals & Materials Society (1988).

AD

FROST, H.J., THOMPSON, C.V., and WALTON, D.T., "Abnormal Grain Growth in Thin Films Due to Anisotropy of Free-Surface Energies," *Materials Science Forum*, Vols. 94-96, pp. 543-550, Trans Tech Publications, Switzerland (1992).

AE

FROST, H.J. and THOMPSON, C.V., "Microstructural Evolution in Thin Films," presented at the Symposium on Computer Simulation of Microstructural Evolution, Toronto, Canada, October 15 (1985).

AF

FROST, H.J. THOMPSON, C.V., and WALTON, D.T., "Grain Growth Stagnation and Abnormal Grain Growth in Thin Films," presented at TMS-AIME Fall Meeting, Indianapolis, IN (1989).

AG

REED-HALL, et al., "Physical Metallurgy Principles," pp. 270, 286 and 287, 83rd Ed. (1991).

AH

STOYCHEV, D.S., and AROYO, M.S., "On the Influence of Pulse Frequency upon the Hardness of Bright Copper Electrodeposits," (citation unknown but believed to be published more than one year before the date of this patent application).

AI

FROST, H.J. and THOMPSON, C.V., "Modeling of Optical Thin Films," reprint from Proceedings of SPIE (International Society for Optical Engineering, San Diego, CA 1987, printed by the Society of Photo-Optical Instrumentation Engineers (1988).

AJ

WALTON, D.T., FROST, H.J. and THOMPSON, C.V., "Computer Simulation of Grain Growth in Thin-Film Interconnect Lines," *Mat. Res. Soc. Symp. Proc.*, vol. 225 (1991).

EXAMINER

D.M. Collins

DATE CONSIDERED

11/8/01

* EXAMINER: Initial if reference considered, whether or not criteria is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant(s).